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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/730,891	12/10/2003	Ying Zhang	20140-00317-US	5178
30678 7590 05/11/2007 CONNOLLY BOVE LODGE & HUTZ LLP P.O. BOX 2207 WILMINGTON, DE 19899-2207			EXAMINER MUSTAPHA, ABDULFATTAH B	
			ART UNIT	PAPER NUMBER
			2812	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/730,891

Applicant(s)

ZHANG ET AL.

Examiner

Abdulfattah Mustapha

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04/10/2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-12,15,16 and 18-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-12,15,16 and 18-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>12/10/2003</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

Claims 3, 15, and 18 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim.

Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claims 3, 15, and 17 depend on canceled claims 2, 14 and 18 respectively.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3 – 7 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding et al. [5,814,563] in view of Obeng [6,162,733].

As to claims 1 and 16, Ding et al. disclose providing at least one pre-doped conductive layer on a gate stack, wherein said gate stack comprise a substrate and at least on gate dielectric provided on said substrate, (Ding et al.: [Col. 2, Line 31-37]), and etching said at least one conductive layer by exposing it to an etching composition, wherein said etching composition comprises at least one carbon containing gas (Ding et al.: [Col. 2, Line 37-45]), (i) gases having the chemical formula C_xH_y , wherein x is an

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integer ranging from 1 to 10, and Y is an integer ranging from 2 to 22; and (ii) gases having the chemical formula C_xH_yA , wherein x is an integer ranging from 1 to 10, Y is an integer ranging from 0 to 21, and A represents at least one additional substituent selected the group consisting of O, N, S, P, F, Cl, Br, I, and combinations of the same. {Ding et al.: [Col. 2, Line 62-67]}, but did not disclose etching composition comprises a halogen-based plasma; and a gas selected from the group consisting of O_2 , N_2 , and mixtures of the same; but Obeng disclose etching composition comprises a halogen-based plasma; and a gas selected from the group consisting of O_2 , N_2 , and mixtures of the same. However Obeng et al. disclose etching composition comprises a halogen-based plasma; and a gas selected from the group consisting of O_2 , N_2 , and mixtures of the same; but Obeng disclose etching composition comprises a halogen-based plasma; and a gas selected from the group consisting of O_2 , N_2 , and mixtures of the same {Obeng: [Col. 2, Line 57-65]}. It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding etching composition comprises a halogen-based plasma; and a gas selected from the group consisting of O_2 , N_2 , and mixtures of the same in order to remove contaminants.

As claims 3 and 18, Ding et al did not specifically disclose halogen based plasma, but disclose etchants selected from the group consisting of CF_4 , CHF_3 , SF_6 , NF_3 , Cl_2 , BCl_3 , HBr , Br_2 , I_2 and mixtures of the same {Ding et al.: [Col2, Line 62-67]}; and the carbon containing gas is selected from the group consisting of CH_4 , C_2H_2 , C_2H_4 , C_2H_6 , C_3H_6 , C_3H_8 , C_4H_8 , C_4H_{10} , C_5H_{12} , C_5H_{10} , C_6H_{14} , C_6H_{12} , C_6H_{10} , C_6H_6 , CH_3OH ,

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C₂H₅OH, C₃H₇OH, CH₃Cl, CH₂Cl₂, and mixtures of the same. {Ding et al.: [Col. 3, Line 1-4]}, but Obeng disclose halogen based plasma {Obeng et al.: [Col. 2, Line 58-59]}. It would have been obvious for It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding halogen based plasma in order to etch metal-containing layers to form a patterned metal-containing layer.

As to claims 4, 5, 19 and 20, Ding et al. in view of Obeng shows all the elements except the amount of carbon containing gas in the etching composition ranges from about 0.1% to about 50% by volume of the etching composition, based on the total volume of the etching composition. Given the teaching of the references, it would have been obvious to determine the optimum thickness, width, size, length, volume, temperature as well as condition of delivery of the layers involved. See *In re Aller*, Lacey and Hall (10 USPQ 233-237). It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

As to claim 6, Ding et al. disclose conductive material selected from the group consisting of Si, Ge, SiGe, and SiGeC, and mixtures, alloys, or multilayer of the same. {Ding et al.: [Col. 3, Line 49 – 54]}.

As to claim 7, Ding et al. disclose conductive layer comprising poly-Si. {Ding et al.: [Col. 3, Line 62-65]}.

Claims 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding et al. [5,814,563] in view of Obeng [6,162,733] as applied to claim 1 above, and further in view of Kito et al. [6,867,450].

As to claim 8, Ding et al. in view of Obeng disclose all the elements of the claim except providing at least one first hardmask layer on said pre-doped conductive layer, wherein said at least one first hardmask layer comprises at least one hardmask material selected from the group consisting of silicon nitride, silicon carbide, silicon hydrogenated carbide, silicon oxidized carbide, and silicon nitridized carbide, and mixtures, alloys, or multilayer of the same; providing at least one second hardmask layer on said at least one first hardmask layer, wherein said at least one second hardmask layer comprises at least one hardmask material selected from the group consisting of silicon oxide, silicon nitride, silicon oxynitride, and silicon carbamide, and mixtures, alloys, or multilayer of the same; (Kito et al.: [Col. 7, Line 46 – 67, to, Col. 8, Line 1 – 9; Col 8, Line 48 – 60; Figure 8A – 34A]), and etching back said at least one first and said at least one second hardmask layers to a width of at least about 3 nm.

(Kito et al.: [Col. 8, Line 1 – 9; Col. 8, Line 31 – 35]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding above stated element in order to stop/resist etching by carbon fluorine.

As to claim 9, Ding et al. in view of Obeng disclose all the elements of the claim except the first hardmask layer comprises silicon nitride, said second hardmask layer comprises tetraethylorthosilicate (TEOS), and said first and second hardmask layers are etched to a width ranging from about 5 nm to about 150 nm. But Kito et al. disclose first hardmask layer comprises silicon nitride, said second hardmask layer comprises tetraethylorthosilicate (TEOS), and said first and second hardmask layers are etched to a width ranging from about 5 nm to about 150 nm. (Kito et al.: [Col. 7, Line 55 – 67; Col. 8, Line 1 – 9]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding above stated element in order to determine the current drive power.

As to claim 10, Ding et al. in view of Obeng disclose all the elements of the claim except etching back said conductive layer to a width of at least about 3 nm, but Kito et al. disclose etching back said conductive layer to a width of at least about 3 nm. (Kito et al.: [Col. 9, Line 36 – 38]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding etch back conductive layer to a width of at least about 3nm, in order to be able to bury insulation film.

As to claim 11, Ding et al. in view of Obeng disclose all the elements of the claim except etching back said conductive layer to a width of at least about 3 nm, but Kito et al. disclose etching back said conductive layer to a width of at least about 3 nm. (Kito et al.: [Col. 9, Line 36 – 38]). It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of Ding et al. by adding etch back conductive layer to a width of at least about 3nm, in order to be able to bury insulation film.

As to claim 12, Ding et al. in view of Obeng disclose all the elements of the claim except conductive material having a thickness ranging from about 10 to about 30nm above said gate dielectric and the method further comprises: exposing the gate dielectric in an over etch (OE) step, wherein said gate is exposed to an OE composition comprising a Br and/or Cl based plasma. However the examiner take official notice that thickness range and Br and Cl based plasma are notoriously old and well known in the art. It would have been obvious to one of ordinary skill in the art to modify the method of Ding et al by adding thickness ranging from about 10 to 30nm above said gate dielectric in order to electrically isolate devices or interconnect lines from the substrate, and by adding OE composition comprising a Br and Cl based plasma in order to reduce the contact resistance and ensure reliable device performance.

Response to Arguments

Applicant's arguments filed 04/10/2007 have been fully considered but they are not persuasive.

The Applicant argues that Ding et al did not anticipate amended claims 1 and 16, in view of the amended claims 1 and 16, the examiner note this, but the claims are unpatentable over Ding et al. in view of Obeng. The applicant also argues that there is no teaching or suggestion from the reference that both a fluorohydrocarbon gas and an NH₃ generating gas could be further advantageously combined with either a halogen-based plasma or a gas selected from the group consisting of O₂, N₂ and mixtures of the same. It is advantageous to use the combination in removing alkali metal contaminants. {Obeng et al.: [Col. 3; Line 6 – 23], [Col. 4; Line 4 – 10]}.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any


extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Abdulfattah Mustapha whose telephone number is 571-272-9736. The examiner can normally be reached on Mon-Thus. (7:00am - 6:00pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on 571-272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Abdulfattah Mustapha


MICHAEL LEBENTRITT
SUPERVISORY PATENT EXAMINER